

ROBOSCOPE VTM-5000/COMPOZITE

LASER SCANNING AND FLAW DETECTION BENCH

for NDT of parts
made of polymer composite materials (PCM),
used in aircraft construction



1 PURPOSE

The stand for laser scanning and flaw detection **Roboscope VTM-5000/COMPOZITE** complete for automated non-destructive testing of blades and airframe units made of PCM (hereinafter referred to as **Roboscope VTM-5000/COMPOZITE**) is intended for laser scanning (measurement of geometric parameters), and non-destructive methods of testing blades and airframe assemblies during production, operation and repair in automatic mode in order to detect defects and structural anomalies of products made of PCM and other materials.

Roboscope VTM-5000/COMPOZITE provides:

- carrying out ultrasonic testing (UT) in echo-pulse or shadow modes using single-element piezoelectric transducers or using transducers on phased arrays;
- conducting eddy current testing (ET) of parts and products made of conductive non-magnetic and ferromagnetic materials;
- impedance control (MIA) of parts and products made of composite materials and honeycomb structures;
- conducting non-contact laser scanning (VT) of parts and assemblies to determine their geometric parameters;
- electrical capacitive control of parts and assemblies made of non-conductive materials;
- free vibration control of parts and products made of composite materials and honeycomb structures;
- marking of detected defects;
- automatic notification in case of detection of defects.

2 TECHNICAL CHARACTERISTICS

Roboscope VTM-5000/COMPOZITE is an automated software and hardware complex and can work autonomously or in the technological chain of production, maintenance and repair of products, parts, assemblies. General view and overall dimensions of the **Roboscope VTM-5000/COMPOZITE** installed in the working area is shown in **Fig. 1, Fig. 2**.

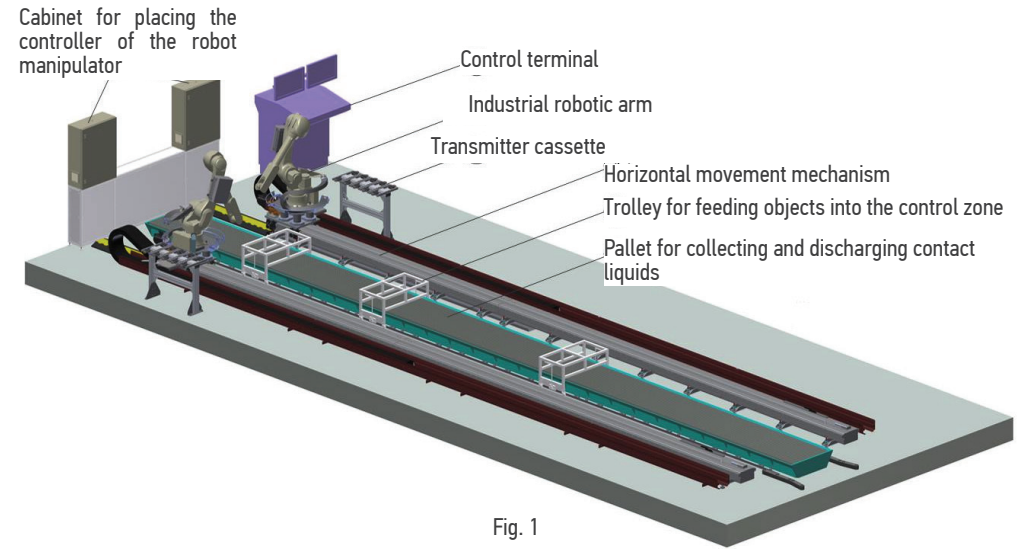


Fig. 1

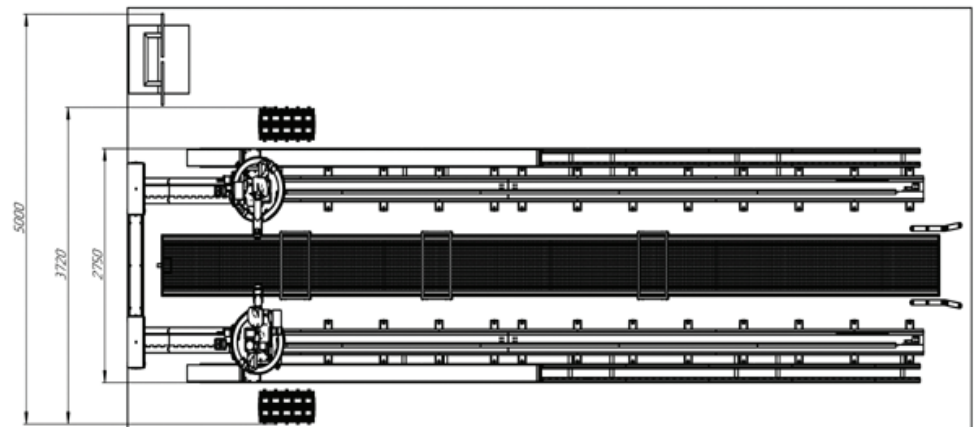
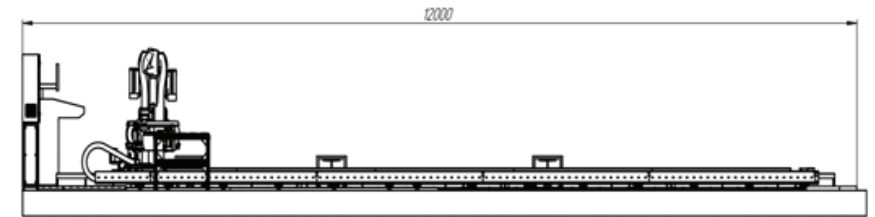


Fig. 2

2.1 General technical characteristics of Roboscope VTM-5000/COMPOZITE are presented in Table 1.

Table 1

Description of characteristics	Value
Flaw detection unit	
Supported non-destructive testing methods: - laser measurement of geometric parameters, - ultrasonic (echo, shadow), - ultrasonic on phased array, - eddy current, - impedance, - electrocapacitive, - free vibrations.	+ + + + + +
Scanning speed, m ² per hour	2,0
The calculation of the location of the reflector is carried out taking into account the geometry of the part	+
Sound and light signaling of defect detection	+
Automatic transducer change	+
Automatic couplant supply system	+
Couplant type	water
Mechanical movement system	
Amount of independent manipulators, pcs	2
The amount of degrees of freedom of the manipulator	6
Manual control of a robotic arm	+
Two-way access of manipulators to the part	+
Degree of protection of the robotic arm	IP67
Linear and complex profile trajectory scanning	+
Basic position of manipulators for safe and convenient installation (removal) of the controlled object	+
Unambiguous, reproducible attachment of transducers to the scanning system	+

Description of characteristics	Value
The speed of the transducer movement at the test object, m/s	0 ÷ 1,0
Control object	
Control object length, no more, m	10,0
Control object width, no more, m	1,0
Control object height, no more, m	2,0
Test object material: - carbon fiber; - fiberglass; - organoplastic; - aluminum; - steel.	+ + + + +
Control terminal	
Control, display and information processing facilities (general control terminal, industrial computer)	+
Time to establish the operating mode, min, no more	15
Self-diagnosis system	+
Password protection for access to the system	+
Overall dimensions of the control terminal (L x W x H), mm	900x800x1600
Control terminal weight, kg, no more	100
General characteristics	
Time of continuous work, hours per day, not less	24
Protective grounding	+
Operating temperature, ° C	from +15 to +35
Relative air humidity (at a temperature of 35 ° C), no more	95%
Power Options - mains voltage, V - frequency Hz	380/220 50±1
Maximum power consumption, kVA	10,0

Description of characteristics	Value
Full weight of all equipment, kg, no more	5000
Overall dimensions (L x H x W) of the mechanical part (including the control terminal), mm, no more	12000x1600x5000
Average service life of equipment before overhaul, years	5
Equipment service life, years	10

2.2 The characteristics of the laser scanning channel of the **Roboscope VTM-5000/COMPOZITE** are presented in **Table 2**.

Table 2

Description of characteristics	Value
Working range of measured distances in the direction of the laser beam*, mm	100÷350
Radiation power, mW, no more	15
Base coordinate system (number of measurement coordinates)	XOZ (2)
Wave length, nm	660
Data refresh rate*, profiles/second	250
Measurement error of geometric dimensions (depending on the range of the measured distance in the direction of laser radiation),%	±0,1
Protection class	IP67

2.3 The characteristics of the ultrasonic scanning channel of the **Roboscope VTM-5000/COMPOZITE** in single-channel mode are presented in **Table 3**.

Table 3

Description of characteristics	Value
Contact and non-contact ultrasonic axle inspection	+
Automatic gain control (AGC) to maintain the required level of sensitivity of ultrasound channels	+
Automatic tracking mode for the presence of acoustic contact	+
Signal amplitudes measurement range at the receiver input, dB	67÷107

Description of characteristics	Value
Limits of permissible absolute error in measuring signal amplitudes at the receiver input, dB	±0,5
Limits of the permissible absolute error of setting the threshold indicator (dead zone), dB	±0,3
Time instability of the threshold indicator response level for 8 hours of operation, dB	±0,5
Nominal values of the amplitude of excitation pulses at a load of 50 Ohm, V	75; 150; 225
Relative error of setting the amplitude of excitation pulses,%	±20
Half-wave duration of the excitation pulse generator (EPG), ns	25÷1250
Relative error of setting the half-wave duration of the EPG pulse,%	±10
Pulse repetition rate of EPG, Hz, not less	500
Maximum sensitivity at a frequency of 5 MHz with a signal-to-noise ratio of 6 dB, μV	150
The receiver bandwidth should be at minus 3 dB, MHz	0,2÷10
Receiver sensitivity adjustment range, dB, not less	90

2.4 The characteristics of the ultrasonic scanning channel of the **Roboscope VTM-5000/COMPOZITE** in the multichannel mode (in the phased array control mode) are presented in **Table 4**.

Таблица 4

Description of characteristics	Value
Amount of independent generator channels	16
Nominal values of the amplitude of excitation pulses, V	145
Relative error of setting the amplitude of excitation pulses,%	±10
Half-wave duration of the excitation pulse generator (EPG), ns	20÷1000
Relative error of setting the half-wave duration of the EPG pulse,%	±10
Receiver sensitivity adjustment range, dB	90
Receiver bandwidth at minus 3 dB, MHz	0,4÷10

Description of characteristics	Value
Pulse repetition rate of EPG, Hz, not less	250
Availability of digital filtering	+
The number of points for plotting the curve of temporary sensitivity adjustment (TSA)	32

2.5 The characteristics of the VTK Roboscope VTM-5000/COMPOZITE channel are presented in **Table 5**.

Table 5

Description of characteristics	Value
GIV working frequency range, kHz	$(1 \div 1000) \pm 10\%$
Pulse repetition frequency of the generator, Hz, not less	1000
Nominal value of the amplitude of excitation pulses at an equivalent load of 100 Ohm, V	more than 4
The minimum depth of the detected defect, mm	0,2
Gain adjustment range, dB	0 ÷ 50
Signal presentation methods	on the complex plane
Separate signal scaling	along the axes OX and OY
Supported operating modes	static
Types of displaying the zone of automatic defect signalling (ADS)	circular, sector

2.6 The characteristics of the IMK Roboscope VTM-5000/COMPOZITE channel are presented in **Table 6**.

Table 6

Description of characteristics	Value
EPG working frequency range, kHz	$(1 \div 1000) \pm 10\%$
Pulse repetition frequency of the generator, Hz, not less	1000
Nominal value of the amplitude of excitation pulses at an equivalent load of 100 Ohm, V	more than 4
The minimum area of the detected defect, mm ²	42

Description of characteristics	Value
Gain adjustment range, dB	0 ÷ 50
Signal presentation methods	on the complex plane
Separate signal scaling	along the axes OX and OY
Supported operating modes	static
Types of displaying the zone of automatic defect signalling (ADS)	circular, sector

2.7 The characteristics of the electrocapacitive control channel of the VTK Roboscope VTM-5000/COMPOZITE are presented in **Table 7**.

Table 7

Description of characteristics	Value
GIV working frequency range, kHz	$(1 \div 1000) \pm 10\%$
Pulse repetition frequency of the generator, Hz, not less	1000
The minimum area of the detected defect, mm ²	30
Gain adjustment range, dB	0 ÷ 50
Signal presentation methods	amplitude
Supported operating modes	static
Types of displaying the zone of automatic defect signalling (ADS)	circular, sector

2.8 The characteristics of the channel of the method of free vibrations of Roboscope VTM-5000/COMPOZITE are presented in **Table 8**.

Table 8

Description of characteristics	Value
GIV working frequency range, kHz	1÷5
The minimum area of the detected defect, mm ²	42
Gain adjustment range, dB	0 ÷ 50
Signal presentation methods	amplitude
Types of displaying the zone of automatic defect signalling (ADS)	strobe

3 SCOPE OF DELIVERY

Scope of delivery **Roboscope VTM-5000** complete for automated non-destructive testing of blades and airframe assemblies made of PCM is shown in **Table 9**.

Table 9

Nº	Name and designation	Quantity
1.	Horizontal movement mechanism with control unit	2 pcs
2.	Industrial robot arm with power supply and manual control panel	2 pcs
3.	Cabinet for placing the controller of the robot manipulator	2 pcs
4.	Transmitter shock protection system	2 pcs
5.	Software-controlled gripper	2 pcs
6.	Industrial cabinet for placement of stand electronic equipment (Control terminal)	1 pcs
7.	Monitor for displaying information	2 pcs
8.	Electronic unit for flaw detection	2 pcs
9.	Connecting cables	2 sets
10.	Automatic defect signalling system	2 pcs
11.	Transducer block kit	2 sets
12.	Transducers set	2 sets
13.	Trolley for feeding objects into the control zone	4 pcs
14.	Rail guides for feeding objects into the control area	1 set
15.	Cassette for transducers and samples	2 pcs
16.	Ultrasonic standard sample CO-3R for testing the performance of ultrasonic channels	1 pcs

Nº	Name and designation	Quantity
17.	Eddy current tuning sample OH-4 for testing the operability of eddy current channels	1 pcs
18.	Measure of defects type TS-2 for testing the performance of impedance and impact flaw detection channels	1 pcs
19.	Air preparation unit	1 pcs
20.	Couplant preparation unit	1 pcs
21.	Tray for collecting and draining the couplant	1 pcs
22.	Laser scanning and flaw detection stand Roboscope VTM-5000 . Manual	1 pcs
23.	Laser scanning and flaw detection stand Roboscope VTM-5000 . Verification method	1 pcs
24.	Laser scanning and flaw detection stand Roboscope VTM-5000 . Passport	1 pcs
25.	Initial verification certificate	1 pcs
26.	Additional documentation	1 set
27.	Software Roboscope VTM-5000	1 pcs